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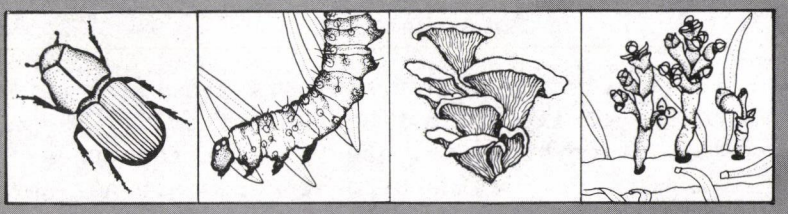

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# DWARF MISTLETOE MANAGEMENT IN THE NORTHERN REGION: IS IT COST-EFFECTIVE?

by

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## ABSTRACT

An investment is an expenditure made with expectation of future gains, financial or otherwise. Dwarf mistletoe management, and even forest management itself, often involves investment for social and community benefits without expectations of direct financial gain. The USDA Forest Service Northern Region's dwarf mistletoe program, 1966 to 1981, is used as an example of cost-effectiveness in forest disease management. Harvesting during the same period is reviewed and its relationship to dwarf mistletoe control is discussed. If harvesting was done correctly, dwarf mistletoe prevention was accomplished on a much larger area at a much cheaper price than could have been done by direct control. If pathologists continue providing adequate training to resource managers, and the managers apply this training from the early planning stages in forest management and timber sales, they can buy more with limited dollars. Prevention is cheaper than suppression.

## FOREST MANAGEMENT POLICIES AND OBJECTIVES

National and Regional Forest Service policy is to manage resources for multiple benefits; an important aspect of this is the practice of forestry. One objective of forestry is the production of something useful to people. Land managers must decide where to put management efforts and capital in order to reach whatever production goals have been set. The limits on available labor and capital, plus other constraints such as legislative and noncommodity considerations, do not permit achieving full productivity on every acre. Managers seek to spend what money they have in those areas where they can buy the most growth and quality (Newport 1962).

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In addition to timber, forests provide a variety of noncommodity values that normally are not bought and sold. These include scenic amenities, recreation benefits, and wildlife resources. Their relative worth is difficult to define because users are not forced or even accustomed to decide what they will give up to obtain such benefits (Echelberger and Wagar 1979). The importance of noncommodity values has grown tremendously during the past 20 years. This growth can be attributed largely to an affluent society in which the quality of life is increasingly important (Echelberger and Wagar 1982). Part of that quality of life comes from the noncommodity values of forests found during leisure hours.

## FOREST DISEASES AND FOREST MANAGEMENT

Forest diseases affect forests by causing outright mortality, reducing timber quantity and quality, possibly removing areas from production, and predisposing trees to more spectacular damage by bark beetles, windthrow, breakage, and fire. Foresters who permit these things in their forest are not practicing "good forestry." If "good forestry" is their objective, then attention must be given to forest diseases.

Forest diseases are most efficiently managed through "good forestry." Protection of stands against disease (prevention) should be as much a part of applied silviculture as harvesting or regeneration. Prevention usually involves only slight modification of silvicultural systems. The wrong system can lead to or perpetuate the problem; the right system can help solve it (Stark 1979).

Some past "not so good forestry" has resulted in a backlog of areas with increased damage from dwarf mistletoe. We have been spending Forest Pest Management (FPM) suppression dollars to clean up this backlog. Is it worth it? Based on the following discussion, I think it is.

### Dwarf mistletoe control program history

Since 1966, the Northern Region has "controlled" dwarf mistletoe on 69,700 acres at a cost of $780,327 (tables 1 and 2).[1] A detailed listing of these projects for each National Forest by fiscal year is given in tables 3 and 4. This includes only projects in which FPM was directly involved. The control program consists of presuppression surveys, overstory removal, thinning/sanitation, site rehabilitation, and some postsuppression surveys. Many more acres of control accomplished during regular timber harvests and other stand entries are discussed in the "Cutting history and dwarf mistletoe control" section.

The objective for all dwarf mistletoe control projects is reduction of losses to acceptable levels. Criteria for FPM financing are (1) projects must be biologically sound, and (2) they must be capable of achieving the control objective at a reasonable cost.

[1]All tables are in the Appendix, following Literature Cited.

## Economic analysis of the control program

Cost of the dwarf mistletoe control program has varied from $2.60 to $33.32 per acre (table 1). Remember that the program includes both presuppression surveys and stand manipulations to reduce or prevent infestation. Costs for direct stand work such as overstory removal, thinning/sanitation, and site rehabilitation have been much higher, and have been increasing rapidly. Stand manipulation costs in the late 1960's were $10 to $20 per acre; some recent costs have exceeded $100 per acre. Control costs have increased much more rapidly than stumpage values. Stumpage values in the late 1960's were in the $35 to $50 per thousand board feet (MBF) range; recent values have seldom exceeded that.

Here is a sample economic analysis based on these data:

Control costs $90/acre

Years to product
- Thin 80
- Harvest 100

Yield prediction (derived from loss figures in Dooling and Eder 1981).

No treatment: 10 MBF/acre

Treatment
- Thin: 2 MBF/acre
- Harvest: 20 MBF/acre

Stumpage $50/MBF

Discount rate 4 percent

| Year | Volume without treatment (MBF/acre) | Volume with treatment (MBF/acre) | Benefit of treatment (MBF/acre) | Benefit value at harvest 1/ ($/MBF) | Present value of benefit 2/ ($/MBF) | Project cost ($/acre) |
|---|---|---|---|---|---|---|
| 0 | - | - | - | - | - | $90.00 |
| 80 | - | 2 | 2 | $ 487.54 | $21.16 | - |
| 100 | 10 | 20 | 10 | 3,622.30 | 71.72 | - |
| | | | | | $92.88 | $90.00 |

1/ Average stumpage of $50/MBF increased at 2 percent compound interest.

2/ Harvest value discounted to present at 4 percent.

Present net worth (PNW) is the difference between present value of benefits and project cost: $2.88/acre. The benefit/cost ratio is 1.03/1. Increasing stumpage values over time makes the project barely economically viable.

Present value of benefits and benefit/cost ratios fluctuate widely if (1) stumpage values change, (2) commercial thinnings are possible, (3) yield predictions are wrong, or (4) rotation age changes (Dooling 1982).

Another factor that should be taken into consideration in an economic analysis of dwarf mistletoe control is that it generates additional employment in the forest products industry. This results in what economists call value added. While value added cannot be used in calculating present value of benefits or benefit/cost ratios, it is substantial enough to be considered when determining overall benefits. Each million board feet of timber cut creates 7.3 person years of employment paying an average of $18,500 per year (Personal communication; Charles Keegan and Paul Polzin, Bureau of Business and Economics Research, University of Montana, Missoula, Montana).

If, for example, we increase our yield at harvest from 15 MBF to 20 MBF per acre by dwarf mistletoe control, we gain 0.036 years of employment and add $666 to the economy for each acre in the treatment area.

Some control projects do not show a positive return, but the overall benefits, such as reducing or eliminating dwarf mistletoe for more than a single rotation, and increasing present and future employment, sometimes outweigh strict financial considerations.

Control also protects other investments such as costs for site preparation, planting, and timber stand improvement.

An economic analysis is appropriate when measuring the benefits of dwarf mistletoe control, but it is not a panacea. There are two groups of people who are concerned about the use of economic analyses to the possible exclusion of other criteria: The first group wants to practice "good forestry" for the sake of "good forestry" rather than for the sake of producing a maximum of useful things at a minimum of cost and effort. Criticisms of economic analyses made by these people should be ignored (Newport 1962).

The second group criticizes economic analyses because they fail to take account of those values which are not directly measurable in terms of dollars. This is a valid criticism (Newport 1962). If the noneconomic criteria to be used to guide land management are given the same thorough and objective treatment as that which is possible in economic analysis, then there should be no fear that economic considerations will be overemphasized (Newport 1962).

Any analysis, economic or otherwise, does not provide definitive answers but rather decision guidelines. Seldom is an analysis so all-inclusive in its coverage that it can be used as a "cookbook"; the exercise of professional judgment is still needed.

## Cutting history and dwarf mistletoe control

Since 1966, nearly 911 thousand ( M) acres have been harvested on the Northern Region's forests by systems that reduce dwarf mistletoe impact (table 5). Detailed harvest data are given in tables 6 and 7. We can assume that about 145 M of these acres were dwarf mistletoe-infested (Dooling and Eder 1981, unpublished data). Systems used were clearcut, seed tree/shelterwood, overstory removal, and rehabilitation cuts; pathologists have long recommended these as dwarf mistletoe management practices. Although selection cuts can help reduce dwarf mistletoe impact, they are not considered here.

If these cuts were properly made, dwarf mistletoe control (prevention) was accomplished on an area about twice as large as that on which FPM has had direct financial involvement. I would like to think this is so; over the years pathologists have stressed the seriousness of dwarf mistletoe impact on volume production, instructed in silvicultural control of the pest, and advised on individual prescriptions.

Through a combination of timber harvesting and more direct measures financed by FPM, some level of dwarf mistletoe reduction has been achieved on slightly more than 200 M acres since 1966 (table 8).

## A cheap approach to dwarf mistletoe control

Each year the Region is asked to produce more timber and other useful things on less area. To achieve this goal, at least some measure of control should be exercised over dwarf mistletoe, especially since it is relatively easy to deal with (Dooling and Eder 1981). Even though many direct suppression projects are cost-effective, it makes no sense to do the job separately when it can be done cheaper, or often at no additional cost [2/] at the time of regeneration cutting.

## Recommendations

My recommendations are:

1. Continue advanced insect and disease management training for resource managers. No forest land management plan can be complete without incorporation of forest protection planning (not reaction).

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2/ This will not be exactly "free"; there are some costs I have not calculated. FPM conducts insect and disease management training that takes the resource manager's time and money. But these training costs are certainly no larger than those needed to administer direct suppression projects, and much more cost effective.

2. Write prescriptions that will prevent dwarf mistletoe infestation in the next rotation. If properly planned and executed, these silvicultural treatments can be applied at little or no additional cost during thinning, regeneration cutting, and site preparation.

3. Follow up to determine if regenerated stands are free of dwarf mistletoe infestation. Treatment has become a routine part of silviculture in many parts of the Region, but the sins of the past (ignoring dwarf mistletoes) are still repeated in many parts, too.

4. Continue to clean up the backlog of harvested stands in which dwarf mistletoe was not treated. An investment of suppression funds in these stands will return them to productivity even though the financial return may sometimes be marginal.

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Table 1.--Dwarf mistletoe control program accomplishments and costs, 1966-1981.

| Fiscal year 1/ | Acres | Total cost | Cost/acre 2/ |
|---|---|---|---|
| 1966 | 890 | $ 9,835 | $11.05 |
| 1967 | 1,824 | 16,262 | 8.92 |
| 1968 | 984 | 16,851 | 17.12 |
| 1969 | 2,626 | 36,191 | 13.78 |
| 1970 | 1,721 | 57,348 | 33.32 |
| 1971 | 3,975 | 60,018 | 15.10 |
| 1972 | 8,541 | 116,295 | 13.62 |
| 1973 | 7,673 | 155,386 | 20.25 |
| 1976 | 6,125 | 152,716 | 24.93 |
| 1978 | 12,687 | 32,999 | 2.60 |
| 1979 | 15,225 | 45,436 | 2.98 |
| 1980 | 4,836 | 41,094 | 8.50 |
| 1981 | 2,593 | 39,896 | 15.39 |
| | 69,700 | $780,327 | $11.20 |

1/ No Forest Pest Mmanagement funds available in 1974, 1975, and 1977.

2/ Cost/acre has varied because of different mixes of surveys and direct stand treatments.

Table 2.--Dwarf mistletoe control program accomplishments by National Forest, 1966-1981.

| National Forest | Acres |
|---|---|
| Beaverhead | 4,868 |
| Bitterroot | 6,162 |
| Deerlodge | 6,979 |
| Flathead | 6,629 |
| Gallatin | 19,480 |
| Helena | 3,050 |
| Kaniksu | 1,845 |
| Kootenai | 3,628 |
| Lewis & Clark | 6,338 |
| Lolo | 8,706 |
| Nezperce | 1,015 |
| | 68,700 |

Table 3.--Dwarf mistletoe control history in Region 1, 1966-1981.

| Fiscal year 1/ Forest | Species 2/ | Acres | Cost |
|---|---|---|---|
| FY 1966 | | | |
| Deerlodge | LP | 590 | $ 5,900 |
| Kootenai | WL, DF | 300 | 3,935 |
| | | 890 | $ 9,835 |
| FY 1967 | | | |
| Beaverhead | LP | 640 | 3,190 |
| Gallatin | LP | 1,084 | 11,922 |
| Kaniksu | WL | 100 | 1,150 |
| | | 1,824 | $16,262 |
| FY 1968 | | | |
| Deerlodge | LP | 286 | 2,862 |
| Gallatin | LP | 388 | 4,270 |
| Lolo | DF | 310 | 9,729 |
| | | 984 | $16,861 |
| FY 1969 | | | |
| Bitterroot | DF | 342 | 8,547 |
| Deerlodge | LP | 1,436 | 14,364 |
| Gallatin | LP | 368 | 3,680 |
| Helena | LP | 150 | 3,000 |
| Lolo | DF | 330 | 6,600 |
| | | 2,626 | $36,191 |
| FY 1970 | | | |
| Deerlodge | LP | 372 | 44,500 |
| Gallatin | LP | 78 | 778 |
| Kaniksu | DF, WL | 1,111 | 10,000 |
| Nezperce | DF, WL | 160 | 2,070 |
| | | 1,721 | $57,348 |

Table 3 (continued)

| Fiscal year 1/ Forest | Species 2/ | Acres | Cost |
|---|---|---|---|
| FY 1971 | | | |
| Beaverhead | LP | 880 | 6,161 |
| Deerlodge | LP | 1,643 | 23,000 |
| Gallatin | LP | 1,119 | 13,427 |
| Kaniksu | DF, WL | 167 | 15,000 |
| Kootenai | WL | 88 | 1,650 |
| Nezperce | DF, WL | 78 | 780 |
| | | 3,975 | $60,018 |
| FY 1972 | | | |
| Beaverhead | LP | 921 | 6,447 |
| Bitterroot | DF | 214 | 7,400 |
| Deerlodge | LP | 1,675 | 20,963 |
| Flathead | DF, WL, LP | 1,892 | 6,857 |
| Gallatin | LP | 831 | 19,947 |
| Helena | LP | 776 | 8,490 |
| Kaniksu | DF, WL, LP | 467 | 15,959 |
| Kootenai | DF | 40 | 4,884 |
| Lewis & Clark | LP | 645 | 7,467 |
| Lolo | DF, WL | 303 | 8,988 |
| Nezperce | DF | 777 | 8,893 |
| | | 8,541 | $116,295 |
| FY 1973 | | | |
| Beaverhead | LP | 2,427 | 27,618 |
| Deerlodge | LP | 1,590 | 54,011 |
| Flathead | WL, LP | 237 | 16,417 |
| Gallatin | LP | 952 | 32,382 |
| Helena | LP | 2,124 | 19,058 |
| Lewis & Clark | LP | 223 | 1,400 |
| Lolo | DF, WL | 120 | 4,500 |
| | | 7,673 | $155,386 |
| FY 1976 | | | |
| Gallatin | LP | 2,500 | 83,013 |
| Lewis & Clark | LP | 125 | 4,513 |
| Lolo | DF | 3,500 | 65,190 |
| | | 6,125 | $152,716 |

Table 3 (continued)

| Fiscal year 1/ Forest | Species 2/ | Acres | Cost |
|---|---|---|---|
| FY 1978 | | | |
| Bitterroot | DF | 146 | 2,666 |
| Deerlodge | LP | 161 | 10,471 |
| Flathead | DF, WL | 1,300 | 5,827 |
| Gallatin | LP | 6,400 | 6,656 |
| Lewis & Clark | LP | 4,680 | 7,379 |
| | | 12,687 | $32,999 |
| FY 1979 | | | |
| Bitterroot | DF | 2,260 | 17,300 |
| Deerlodge | LP | 140 | 6,260 |
| Flathead | WL, LP | 3,200 | 1,050 |
| Gallatin | LP | 5,760 | 4,617 |
| Kootenai | DF, WL | 3,200 | 14,876 |
| Lewis & Clark | LP | 665 | 1,333 |
| | | 15,225 | $45,436 |
| FY 1980 | | | |
| Bitterroot | DF | 2,657 | 27,888 |
| Deerlodge | LP | 86 | 3,107 |
| Lolo | DF, WL | 2,093 | 10,099 |
| | | 4,836 | $41,094 |
| FY 1981 | | | |
| Bitterroot | DF | 543 | 30,439 |
| Lolo | DF, WL, LP | 2,050 | 9,457 |
| | | 2,593 | 39,896 |
| | | 69,700 | $780,327 |

1/ No FPM funds available in 1974, 1975, and 1977.

2/ LP = Lodgepole pine,
DF = Douglas-fir,
WL = Western larch.

Table 4.--Dwarf mistletoe control history in Region 1, 1966-1981, by Forest, by fiscal year.

| Fiscal year 1/ | Beaverhead | Bitterroot | Deerlodge | Flathead | Gallatin | Helena | Kaniksu | Kootenai | Lewis & Clark | Lolo | Nezperce |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1966 | - | - | 590 | - | - | - | - | 300 | - | - | - |
| 1967 | 640 | - | - | - | 1,084 | - | 100 | - | - | - | - |
| 1968 | - | - | 286 | - | 388 | - | - | - | - | 310 | - |
| 1969 | - | 342 | 1,436 | - | 368 | 150 | - | - | - | 330 | - |
| 1970 | - | - | 372 | - | 78 | - | 1,111 | - | - | - | 160 |
| 1971 | 880 | - | 1,643 | - | 1,119 | - | 167 | 88 | - | - | 78 |
| 1972 | 921 | 214 | 1,675 | 1,892 | 831 | 776 | 467 | 40 | 645 | 303 | 777 |
| 1973 | 2,427 | - | 1,590 | 237 | 952 | 2,124 | - | - | 223 | 120 | - |
| 1976 | - | - | - | - | 2,500 | - | - | - | 125 | 3,500 | - |
| 1978 | - | 146 | 161 | 1,300 | 6,400 | - | - | - | 4,680 | - | - |
| 1979 | - | 2,260 | 140 | 3,200 | 5,760 | - | - | 3,200 | 665 | - | - |
| 1980 | - | 2,657 | 86 | - | - | - | - | - | - | 2,093 | - |
| 1981 | - | 543 | - | - | - | - | - | - | - | 2,050 | - |
| | 4,868 | 6,162 | 7,979 | 6,629 | 19,480 | 3,050 | 1,845 | 3,628 | 6,338 | 8,706 | 1,015 |

1/ No FPM funds available in 1974, 1975, and 1977.

Table 5.--Harvesting history in Region 1, 1966-1981. [1/]

| Fiscal years | Acres harvested | | | | |
|---|---|---|---|---|---|
| | Clearcut | Seed/shelter | Removal | Rehab | Total |
| 1966 | 62,822 | 7,096 | 25,490 | 323 | 95,731 |
| 1967 | 50,168 | 8,716 | 25,845 | 160 | 83,889 |
| 1968 | 43,032 | 6,199 | 17,623 | 60 | 66,914 |
| 1969 | 48,149 | 5,543 | 23,137 | 18 | 76,847 |
| 1970 | 47,395 | 5,879 | 20,164 | 100 | 73,538 |
| 1971 | 45,860 | 5,633 | 18,405 | 10 | 69,908 |
| 1972 | 40,087 | 9,736 | 21,447 | - | 71,270 |
| 1973 | 36,276 | 11,545 | 19,775 | 101 | 67,697 |
| 1974 | 24,413 | 11,833 | 17,733 | 125 | 54,104 |
| 1975 | 18,069 | 11,290 | 14,028 | 621 | 43,838 |
| 1976 | 19,171 | 13,381 | 15,545 | - | 48,097 |
| 1977 | 11,422 | 17,196 | 15,283 | - | 43,901 |
| 1978 | 9,353 | 10,090 | 10,674 | 5 | 30,122 |
| 1979 | 8,631 | 21,527 | 7,130 | 51 | 37,339 |
| 1980 | 6,177 | 9,183 | 4,502 | - | 19,862 |
| 1981 | 4,839 | 15,531 | 7,563 | - | 27,933 |
| | 475,864 | 170,378 | 264,344 | 1,574 | 910,990 |

[1/] Data from Timber Management, Northern Region.

Table 6.--Harvesting history in Region 1, 1966-1981.

| Fiscal year<br>National Forest | Acres | | | | |
|---|---|---|---|---|---|
| | Clearcut | Seed/shelter | Removal | Rehab. | Total |
| FY 1966 | | | | | |
| Beaverhead | 2,879 | - | 45 | - | 2,924 |
| Bitterroot | 2,420 | 2,109 | 1,427 | 78 | 6,034 |
| Clearwater | 3,593 | 1,299 | 111 | - | 5,003 |
| Coeur d'Alene | 4,781 | 1,428 | 2,174 | - | 8,383 |
| Deerlodge | 2,221 | - | - | 5 | 2,226 |
| Flathead | 8,428 | 797 | 2,482 | 25 | 11,732 |
| Gallatin | 2,525 | - | - | - | 2,525 |
| Helena | 2,561 | 105 | 475 | - | 3,141 |
| Kaniksu | 5,435 | 97 | 3,774 | 98 | 9,404 |
| Kootenai | 12,703 | 322 | 7,953 | 117 | 21,095 |
| Lewis & Clark | 609 | - | - | - | 609 |
| Lolo | 4,582 | 379 | 4,996 | - | 9,957 |
| Nezperce | 4,820 | 474 | 357 | - | 5,651 |
| St. Joe | 5,265 | 86 | 1,696 | - | 7,047 |
| | 62,822 | 7,096 | 25,490 | 323 | 95,731 |
| FY 1967 | | | | | |
| Beaverhead | 2,474 | - | - | - | 2,474 |
| Bitterroot | 2,487 | 2,365 | 451 | - | 5,303 |
| Clearwater | 3,853 | 2,151 | 777 | - | 6,781 |
| Coeur d'Alene | 4,022 | 500 | 3,312 | - | 7,834 |
| Custer | 170 | - | 53 | - | 223 |
| Deerlodge | 2,582 | - | - | 66 | 2,648 |
| Flathead | 4,859 | 1,691 | 2,063 | - | 8,613 |
| Gallatin | 3,401 | - | 32 | - | 3,433 |
| Helena | 1,564 | 105 | 180 | - | 1,849 |
| Kaniksu | 4,849 | 62 | 1,931 | 84 | 6,926 |
| Kootenai | 6,942 | 254 | 5,020 | 10 | 12,226 |
| Lewis & Clark | 2,383 | - | - | - | 2,383 |
| Lolo | 4,426 | 1,418 | 8,664 | - | 14,508 |
| Nezperce | 4,484 | 170 | 390 | - | 5,044 |
| St. Joe | 2,672 | - | 1,972 | - | 4,644 |
| | 51,168 | 8,716 | 24,845 | 160 | 84,889 |

Table 6 (continued)

| Fiscal year<br>National Forest | Acres | | | | |
|---|---|---|---|---|---|
| | Clearcut | Seed/shelter | Removal | Rehab. | Total |
| FY 1968 | | | | | |
| Beaverhead | 948 | - | - | - | 948 |
| Bitterroot | 3,432 | 3,219 | 993 | - | 7,644 |
| Clearwater | 3,799 | 303 | 1,191 | - | 5,293 |
| Coeur d'Alene | 1,960 | 30 | 2,121 | - | 4,111 |
| Custer | 169 | - | - | - | 169 |
| Deerlodge | 3,311 | - | - | - | 3,311 |
| Flathead | 4,819 | 527 | 1,588 | - | 6,934 |
| Gallatin | 2,034 | - | - | - | 2,034 |
| Helena | 2,034 | - | 315 | - | 2,888 |
| Kaniksu | 2,962 | 230 | 581 | - | 3,773 |
| Kootenai | 7,883 | 118 | 6,123 | 60 | 14,184 |
| Lewis & Clark | 646 | - | 6 | - | 652 |
| Lolo | 2,452 | 323 | 4,466 | - | 7,341 |
| Nezperce | 2,617 | 300 | 238 | - | 3,155 |
| St. Joe | 3,427 | 1,149 | - | - | 4,576 |
| | 42,493 | 6,199 | 17,622 | 60 | 67,013 |
| FY 1969 | | | | | |
| Beaverhead | 1,075 | - | - | - | 1,075 |
| Bitterroot | 2,568 | 745 | 1,409 | - | 4,722 |
| Clearwater | 2,696 | 1,246 | 917 | - | 4,859 |
| Coeur d'Alene | 3,529 | 568 | 2,464 | - | 6,561 |
| Custer | 93 | - | - | - | 93 |
| Deerlodge | 2,319 | - | 23 | - | 2,342 |
| Flathead | 6,860 | 1,523 | 5,039 | - | 13,422 |
| Gallatin | 2,163 | - | - | - | 2,163 |
| Helena | 2,417 | - | - | - | 2,417 |
| Kaniksu | 5,798 | 46 | 1,775 | - | 7,619 |
| Kootenai | 7,200 | 152 | 5,746 | - | 13,098 |
| Lewis & Clark | 899 | - | - | - | 899 |
| Lolo | 4,133 | 430 | 5,039 | 18 | 9,620 |
| Nezperce | 2,858 | 810 | - | - | 3,668 |
| St. Joe | 3,541 | 23 | 725 | - | 4,289 |
| | 48,149 | 5,543 | 23,137 | 18 | 76,847 |

Table 6 (continued)

| Fiscal year<br>National Forest | Acres | | | | |
|---|---|---|---|---|---|
| | Clearcut | Seed/shelter | Removal | Rehab. | Total |
| FY 1970 | | | | | |
| Beaverhead | 2,180 | - | - | - | 2,180 |
| Bitterroot | 2,724 | 233 | 1,603 | - | 4,560 |
| Clearwater | 2,780 | 1,525 | 901 | - | 5,206 |
| Coeur d'Alene | 2,458 | - | 1,589 | - | 4,047 |
| Custer | 63 | - | - | - | 63 |
| Deerlodge | 990 | - | - | - | 990 |
| Flathead | 5,372 | 817 | 1,334 | - | 6,523 |
| Gallatin | 3,644 | - | - | - | 3,644 |
| Helena | 954 | - | 35 | - | 989 |
| Kaniksu | 6,723 | 127 | 1,117 | - | 7,967 |
| Kootenai | 8,368 | 719 | 8,745 | 100 | 17,932 |
| Lewis & Clark | 929 | - | 10 | - | 939 |
| Lolo | 4,007 | 984 | 3,296 | - | 8,287 |
| Nezperce | 4,715 | 937 | 1,293 | - | 6,945 |
| St. Joe | 2,488 | 537 | 241 | - | 3,266 |
| | 47,395 | 5,879 | 20,164 | 100 | 73,538 |
| FY 1971 | | | | | |
| Beaverhead | 2,495 | 6 | 82 | - | 2,583 |
| Bitterroot | 1,424 | - | 492 | - | 1,916 |
| Clearwater | 2,818 | 1,011 | 1,836 | - | 5,665 |
| Coeur d'Alene | 3,178 | 686 | 2,646 | - | 6,510 |
| Custer | 26 | - | - | - | 26 |
| Deerlodge | 4,332 | - | - | - | 4,332 |
| Flathead | 3,162 | 672 | 1,605 | - | 5,493 |
| Gallatin | 2,129 | - | - | - | 2,129 |
| Helena | 1,281 | - | - | - | 1,281 |
| Kaniksu | 5,579 | - | 1,079 | - | 6,658 |
| Kootenai | 7,736 | 578 | 4,894 | 10 | 13,218 |
| Lewis & Clark | 1,279 | - | - | - | 1,279 |
| Lolo | 5,146 | 673 | 4,474 | - | 10,293 |
| Nezperce | 2,847 | 730 | 397 | - | 3,974 |
| St. Joe | 2,428 | 1,277 | 900 | | 4,605 |
| | 45,860 | 5,633 | 18,405 | 10 | 69,962 |

Table 6 (continued)

| Fiscal year<br>National Forest | Acres | | | | |
|---|---|---|---|---|---|
| | Clearcut | Seed/shelter | Removal | Rehab. | Total |
| FY 1972 | | | | | |
| Beaverhead | 1,855 | 149 | - | - | 2,004 |
| Bitterroot | 562 | 760 | 1,127 | - | 2,449 |
| Clearwater | 2,302 | 812 | 1,058 | - | 4,172 |
| Coeur d'Alene | 2,206 | 989 | 466 | - | 3,481 |
| Deerlodge | 2,468 | - | - | - | 2,468 |
| Flathead | 5,500 | 1,955 | 1,490 | - | 8,945 |
| Gallatin | 2,172 | - | - | - | 2,172 |
| Helena | 1,249 | - | - | - | 1,249 |
| Kaniksu | 4,192 | 80 | 2,904 | - | 7,176 |
| Kootenai | 9,446 | 1,092 | 2,529 | - | 13,067 |
| Lewis & Clark | 1,725 | - | - | - | 1,725 |
| Lolo | 3,372 | 1,334 | 10,400 | - | 15,106 |
| Nezperce | 1,667 | 112 | 732 | - | 1,511 |
| St. Joe | 1,551 | 2,453 | 741 | - | 4,745 |
| | 40,267 | 9,736 | 21,447 | - | 70,270 |
| FY 1973 | | | | | |
| Beaverhead | 2,351 | - | - | - | 2,351 |
| Bitterroot | 1,518 | 1,291 | 1,243 | - | 4,052 |
| Clearwater | 1,606 | 2,127 | 1,346 | 101 | 5,180 |
| Coeur d'Alene | 1,655 | 1,000 | 1,064 | - | 3,719 |
| Deerlodge | 2,230 | - | 391 | - | 2,621 |
| Flathead | 2,877 | 2,129 | 1,615 | - | 6,621 |
| Gallatin | 711 | - | - | - | 711 |
| Helena | 2,645 | 47 | - | - | 2,692 |
| Kaniksu | 3,908 | 432 | 2,372 | - | 6,712 |
| Kootenai | 6,391 | 533 | 2,844 | - | 9,768 |
| Lewis & Clark | 643 | - | - | - | 643 |
| Lolo | 3,097 | 1,848 | 6,917 | - | 11,862 |
| Nezperce | 5,563 | 476 | 910 | - | 6,949 |
| St. Joe | 1,081 | 1,662 | 1,073 | - | 3,816 |
| | 36,276 | 11,545 | 19,775 | 101 | 67,697 |

Table 6 (continued)

| Fiscal year / National Forest | Acres | | | | |
|---|---|---|---|---|---|
| | Clearcut | Seed/shelter | Removal | Rehab. | Total |
| FY 1974 | | | | | |
| Beaverhead | 1,093 | 512 | - | - | 1,605 |
| Bitterroot | 460 | 1,583 | 904 | - | 2,947 |
| Idaho Panhandle | 5,679 | 1,391 | 3,334 | 64 | 10,468 |
| Clearwater | 1,269 | 1,489 | 557 | - | 3,305 |
| Deerlodge | 1,572 | 289 | 431 | - | 2,292 |
| Flathead | 1,798 | 2,153 | 2,076 | - | 6,027 |
| Gallatin | 1,876 | 7 | - | - | 1,883 |
| Helena | 1,817 | 125 | - | - | 1,942 |
| Kootenai | 5,158 | 2,487 | 5,633 | 61 | 13,339 |
| Lewis & Clark | 666 | - | - | - | 666 |
| Lolo | 2,457 | 1,428 | 4,217 | - | 8,102 |
| Nezperce | 1,578 | 369 | 581 | - | 2,528 |
| | 25,423 | 11,833 | 17,733 | 125 | 55,104 |
| FY 1975 | | | | | |
| Beaverhead | 1,166 | - | - | - | 1,166 |
| Bitterroot | 69 | 135 | - | - | 204 |
| Idaho Panhandle | 4,115 | 1,302 | 2,665 | 487 | 8,569 |
| Clearwater | 716 | 1,340 | 701 | - | 2,757 |
| Deerlodge | 1,010 | - | 314 | - | 1,324 |
| Flathead | 595 | 2,462 | 1,341 | 49 | 4,447 |
| Gallatin | 762 | - | - | - | 762 |
| Helena | 784 | 12 | - | - | 796 |
| Kootenai | 2,280 | 847 | 2,270 | - | 5,397 |
| Lewis & Clark | 608 | 126 | - | 85 | 819 |
| Lolo | 4,729 | 2,134 | 5,264 | - | 12,127 |
| Nezperce | 1,235 | 2,762 | 1,473 | - | 5,470 |
| | 18,069 | 11,120 | 14,028 | 621 | 43,838 |

Table 6 (continued)

| Fiscal year<br>National Forest | Acres | | | | |
|---|---|---|---|---|---|
| | Clearcut | Seed/shelter | Removal | Rehab. | Total |
| FY 1976 | | | | | |
| Beaverhead | 1,490 | 54 | 104 | - | 1,648 |
| Bitterroot | 135 | 127 | 449 | - | 711 |
| Idaho Panhandle | 780 | 1,114 | 752 | - | 1,894 |
| Clearwater | 3,457 | 1,620 | 2,745 | - | 7,912 |
| Deerlodge | 714 | - | 880 | - | 1,594 |
| Flathead | 654 | 3,967 | 1,702 | - | 6,323 |
| Gallatin | 371 | - | - | - | 371 |
| Helena | 197 | 328 | - | - | 525 |
| Kootenai | 5,226 | 2,231 | 5,138 | - | 12,595 |
| Lewis & Clark | 248 | - | 61 | - | 309 |
| Lolo | 3,471 | 1,565 | 2,985 | - | 8,021 |
| Nezperce | 1,338 | 2,375 | 729 | - | 4,442 |
| | 18,081 | 13,381 | 15,545 | - | 46,345 |
| FY 1977 | | | | | |
| Beaverhead | 368 | 70 | - | - | 438 |
| Bitterroot | 26 | 250 | - | - | 276 |
| Idaho Panhandle | 2,515 | 4,692 | 1,381 | - | 8,588 |
| Clearwater | 1,762 | 791 | 1,573 | - | 4,126 |
| Deerlodge | 585 | 214 | 76 | - | 875 |
| Flathead | 218 | 2,514 | 1,221 | - | 3,953 |
| Gallatin | 154 | - | - | - | 154 |
| Helena | 136 | 32 | 9 | - | 177 |
| Kootenai | 4,021 | 3,869 | 8,651 | - | 16,541 |
| Lewis & Clark | 103 | - | 260 | - | 363 |
| Lolo | 527 | 1,437 | 1,155 | - | 3,119 |
| Nezperce | 1,007 | 3,327 | 957 | - | 5,291 |
| | 11,422 | 17,196 | 15,283 | - | 43,901 |

Table 6 (continued)

| Fiscal year<br>National Forest | Acres | | | | |
|---|---|---|---|---|---|
| | Clearcut | Seed/shelter | Removal | Rehab. | Total |
| FY 1978 | | | | | |
| Beaverhead | 1,075 | 71 | - | - | 1,146 |
| Bitterroot | 28 | - | 137 | - | 165 |
| Idaho Panhandle | 812 | 1,149 | 872 | - | 2,833 |
| Clearwater | 1,593 | 1,756 | 884 | - | 4,233 |
| Deerlodge | 826 | 430 | 831 | - | 2,087 |
| Flathead | 219 | 898 | 152 | - | 1,269 |
| Gallatin | 238 | 37 | 161 | - | 436 |
| Helena | 185 | 15 | - | - | 200 |
| Kootenai | 3,397 | 2,838 | 5,595 | - | 11,830 |
| Lewis & Clark | 168 | - | - | 5 | 173 |
| Lolo | 598 | 1,865 | 1,807 | - | 4,270 |
| Nezperce | 214 | 1,031 | 235 | - | 1,480 |
| | 9,353 | 10,090 | 10,674 | 5 | 30,122 |
| FY 1979 | | | | | |
| Beaverhead | 716 | - | - | - | 716 |
| Bitterroot | 260 | 110 | 215 | - | 585 |
| Idaho Panhandle | 782 | 1,418 | 623 | - | 2,823 |
| Clearwater | 2,082 | 3,762 | 2,176 | - | 8,020 |
| Custer | - | 54 | - | - | 54 |
| Deerlodge | 603 | 503 | 176 | - | 1,282 |
| Flathead | 490 | 3,655 | 656 | - | 4,811 |
| Gallatin | 329 | 1,500 | 69 | - | 1,898 |
| Helena | 44 | 55 | - | - | 99 |
| Kootenai | 2,631 | 3,231 | 1,670 | 51 | 7,583 |
| Lewis & Clark | 146 | - | - | - | 146 |
| Lolo | 158 | 1,003 | 756 | - | 1,917 |
| Nezperce | 290 | 6,236 | 789 | - | 7,315 |
| | 8,531 | 21,527 | 7,130 | 51 | 37,249 |

Table 6 (continued)

| Fiscal year<br>National Forest | Acres | | | | |
|---|---|---|---|---|---|
| | Clearcut | Seed/shelter | Removal | Rehab. | Total |
| FY 1980 | | | | | |
| Beaverhead | 382 | 48 | 85 | - | 515 |
| Bitterroot | 16 | 33 | 148 | - | 197 |
| Idaho Panhandle | 527 | 1,043 | 347 | - | 1,917 |
| Clearwater | 673 | 1,580 | 1,446 | - | 3,699 |
| Custer | 57 | 38 | 78 | - | 173 |
| Deerlodge | 191 | 920 | 21 | - | 1,133 |
| Flathead | 914 | 505 | 71 | - | 1,490 |
| Gallatin | 124 | 16 | - | - | 140 |
| Helena | 118 | 72 | - | - | 190 |
| Kootenai | 2,222 | 3,385 | 1,430 | - | 7,037 |
| Lewis & Clark | 188 | - | - | - | 188 |
| Lolo | 342 | 718 | 323 | - | 1,383 |
| Nezperce | 423 | 825 | 553 | - | 1,801 |
| | 6,177 | 9,183 | 4,502 | - | 19,863 |
| FY 1981 | | | | | |
| Beaverhead | 525 | - | 10 | - | 535 |
| Bitterroot | 117 | 1,833 | 239 | - | 2,189 |
| Idaho Panhandle | 468 | 1,017 | 543 | - | 2,028 |
| Clearwater | 297 | 2,672 | 1,253 | - | 4,222 |
| Custer | 7 | 58 | 5 | - | 70 |
| Deerlodge | 119 | 65 | 38 | - | 222 |
| Flathead | 785 | 984 | 308 | - | 2,177 |
| Gallatin | 333 | 483 | 135 | - | 951 |
| Helena | 76 | 147 | - | - | 223 |
| Kootenai | 1,329 | 4,132 | 2,227 | - | 7,738 |
| Lewis & Clark | 19 | - | 201 | - | 220 |
| Lolo | 525 | 857 | 2,223 | - | 3,605 |
| Nezperce | 239 | 3,283 | 331 | - | 3,853 |
| | 4,839 | 15,531 | 7,513 | - | 27,835 |

Table 7.--Harvesting history in Region 1, 1966-1981, acres by Forest.

| Fiscal years | Beaverhead | Bitterroot | Idaho Panhandle | Clearwater | Coeur d'Aléne | Custer | Deerlodge | Flathead | Gallatin | Helena | Kaniksu | Kootenai | Lewis & Clark | Lolo | Nezperce | St. Joe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1966 | 2,924 | 6,034 | - | 5,003 | 8,383 | - | 2,226 | 11,732 | 2,525 | 3,141 | 9,404 | 21,095 | 609 | 9,957 | 5,561 | 7,047 |
| 1967 | 2,474 | 5,303 | - | 6,781 | 7,834 | 223 | 2,648 | 8,613 | 3,433 | 1,849 | 6,926 | 12,226 | 2,383 | 14,508 | 5,044 | 4,644 |
| 1968 | 948 | 7,644 | - | 5,293 | 4,111 | 169 | 3,311 | 6,934 | 2,034 | 2,888 | 3,773 | 14,184 | 652 | 7,241 | 3,155 | 4,567 |
| 1969 | 1,075 | 4,722 | - | 4,859 | 6,561 | 93 | 2,342 | 13,422 | 2,163 | 2,417 | 7,619 | 13,098 | 899 | 9,620 | 3,668 | 4,289 |
| 1970 | 2,180 | 4,560 | - | 5,206 | 4,047 | 63 | 990 | 6,523 | 3,644 | 989 | 7,967 | 17,932 | 939 | 8,287 | 6,945 | 3,266 |
| 1971 | 2,583 | 1,916 | - | 5,665 | 6,510 | 26 | 4,332 | 5,493 | 2,129 | 1,281 | 6,658 | 13,218 | 1,279 | 10,293 | 3,974 | 4,605 |
| 1972 | 2,004 | 2,449 | - | 4,172 | 3,481 | - | 2,468 | 8,945 | 2,172 | 1,249 | 7,176 | 13,067 | 1,725 | 15,106 | 1,511 | 4,745 |
| 1973 | 2,351 | 4,052 | - | 5,180 | 3,719 | - | 2,621 | 6,621 | 711 | 2,692 | 6,712 | 9,768 | 643 | 11,862 | 6,949 | 3,816 |
| 1974 | 1,605 | 2,947 | 10,468 | 3,305 | - | - | 2,292 | 6,027 | 1,883 | 1,942 | - | 13,339 | 666 | 8,102 | 2,528 | - |
| 1975 | 1,166 | 204 | 8,569 | 2,757 | - | - | 1,324 | 4,447 | 762 | 796 | - | 5,397 | 819 | 12,127 | 5,470 | - |
| 1976 | 1,648 | 711 | 1,894 | 7,912 | - | - | 1,594 | 6,323 | 371 | 525 | - | 12,595 | 309 | 8,021 | 4,442 | - |
| 1977 | 438 | 276 | 8,588 | 4,126 | - | - | 875 | 3,953 | 154 | 177 | - | 16,541 | 363 | 3,119 | 5,291 | - |
| 1978 | 1,146 | 165 | 2,833 | 4,233 | - | - | 2,087 | 1,269 | 436 | 200 | - | 11,830 | 173 | 4,270 | 1,480 | - |
| 1979 | 716 | 585 | 2,823 | 8,020 | - | 54 | 1,282 | 4,811 | 1,898 | 99 | - | 7,583 | 146 | 1,917 | 7,315 | - |
| 1980 | 515 | 197 | 1,917 | 3,699 | - | 173 | 1,133 | 1,490 | 140 | 190 | - | 7,037 | 188 | 1,383 | 1,801 | - |
| 1981 | 535 | 2,189 | 2,028 | 4,222 | - | 70 | 222 | 2,177 | 951 | 223 | - | 7,738 | 220 | 3,605 | 3,853 | - |
| | 24,308 | 43,954 | 39,120 | 80,433 | 44,646 | 871 | 31,747 | 98,780 | 25,406 | 20,658 | 56,235 | 196,648 | 12,013 | 129,418 | 68,987 | 36,979 |

Table 8.--Harvesting history and dwarf mistletoe control in Region 1, 1966-1981.

| National Forest | Harvested[1/] | Host type[2/] | Host type w/dwarf mistletoe[3/] | Dwarf mistletoe control projects[4/] | Total dwarf mistletoe reduction |
|---|---|---|---|---|---|
| | | | Acres | | |
| Beaverhead | 24,208 | 18,000 | 9,360 | 4,868 | 14,228 |
| Bitterroot | 43,954 | 35,000 | 14,700 | 6,162 | 20,862 |
| Idaho Panhandle | 39,220 | 20,000 | 6,000 | - | 6,000 |
| Clearwater | 80,433 | 30,000 | 9,000 | - | 9,000 |
| Coeur d'Alene | 44,646 | 20,000 | 6,000 | - | 6,000 |
| Custer | 871 | 600 | 168 | - | 168 |
| Deerlodge | 31,747 | 25,000 | 11,750 | 6,979 | 18,729 |
| Flathead | 98,780 | 45,000 | 13,500 | 6,629 | 20,729 |
| Gallatin | 25,406 | 20,000 | 8,400 | 19,480 | 27,880 |
| Helena | 20,758 | 16,000 | 5,600 | 3,050 | 8,650 |
| Kaniksu | 56,235 | 25,000 | 7,500 | 1,845 | 9,345 |
| Kootenai | 196,648 | 90,000 | 13,500 | 3,628 | 17,128 |
| Lewis & Clark | 12,013 | 10,000 | 3,700 | 6,338 | 10,038 |
| Lolo | 129,418 | 75,000 | 18,750 | 8,706 | 17,456 |
| Nezperce | 69,077 | 40,000 | 12,000 | 1,015 | 13,015 |
| St. Joe | 36,979 | 20,000 | 6,000 | - | 6,000 |
| | 910,393 | 489,600 | 145,928 | 68,700 | 205,228 |

1/ From Appendix table D. Not all these areas were dwarf mistletoe-infested.

2/ Estimate.

3/ From Dooling and Eder 1981, unpublished data 1981.

4/ From Appendix table B.